

# PATENT COOPERATION TREATY



## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 21 NOV 2005

Applicant's or agent's file reference 85/TY00M23/WO		<b>FOR FURTHER ACTION</b>		WIPO PCT
		See Form PCT/PEA/416		
International application No. PCT/IB2004/002455	International filing date (day/month/year) 02.08.2004	Priority date (day/month/year) 08.08.2003		
International Patent Classification (IPC) or national classification and IPC B60L11/18				
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA et al.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 8 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input checked="" type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 31.05.2005		Date of completion of this report 18.11.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer Bronold, H Telephone No. +49 89 2399-2948 		

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/IB2004/002455

---

**Box No. I Basis of the report**

---

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

2-8 as originally filed  
1, 1a, 1b received on 31.05.2005 with letter of 31.05.2005

**Claims, Numbers**

18 as originally filed  
1-17 received on 02.11.2005 with letter of 02.11.2005

**Drawings, Sheets**

1/3-3/3 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/IB2004/002455

---

**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

---

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 6

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 6

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/IB2004/002455

---

**Box No. IV Lack of unity of invention**

---

1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
  - ☒ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
  - ☐ not complied with for the following reasons:
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-5,7-17 .

---

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

---

1. Statement

Novelty (N)	Yes: Claims	1-5, 7-17
	No: Claims	
Inventive step (IS)	Yes: Claims	1-5, 7-17
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-5,11-17
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

---

**Box No. VI Certain documents cited**

---

1. Certain published documents (Rule 70.10)

and /or

2. Non-written disclosures (Rule 70.9)

**see separate sheet**

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/IB2004/002455

---

---

**Box No. VII Certain defects in the international application**

---

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**Re Item V.**

**1. The following documents are referred to in this communication:**

- D1: US 6 107 691 A (GORE GERALD E ET AL) 22 August 2000 (2000-08-22)
- D2: US 2003/046802 A1 (CHERNOFF ADRIAN B ET AL) 13 March 2003 (2003-03-13)
- D3: US-B1-6 220 380 (TAKEUCHI AKISHIRO ET AL) 24 April 2001 (2001-04-24)
- D4: EP-A-0 677 417 (DAIMLER BENZ AG) 18 October 1995 (1995-10-18)

**2. Novelty Art. 33(1) and (2) PCT**

- 2.1 The present application meets the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does involve an inventive step in the sense of Article 33(3) PCT.

Document D3 discloses (the references in parenthesis applying to this document):

A fuel cell equipped vehicle comprising: a power control unit (figure 10, ref. 128) which converts power supplied from a fuel cell (figure 10, ref. 125) and that supplies that converted power to a load (figure 10, ref. 127), a fuel supply source (page 9, paragraph 91, "compressor") and power storing means (page 8, paragraph 90, "battery"), high voltage wiring (figure 10, wiring connecting the fuel cell 125 to the traction motor 127 and the energy conversion system control unit 128) which extends in a longitudinal direction of the vehicle (figure 1) and which connects at least one of the fuel cell and the load to the power control unit, and a fuel line for supplying a fuel gas to the fuel cell which extends in the longitudinal direction of the vehicle (figure 1).

The subject matter of claim 1 differs from the disclosure of D3 in that the high voltage wiring is provided on one side of either the left or the right side of the vehicle with respect to the longitudinal direction of the vehicle, in that the fuel line is provided on the other side of the vehicle in the longitudinal direction, in that the high voltage wiring

and the fuel line are spaced apart from each other in the lateral direction of the vehicle and in that the fuel cell, the power storing means and the fuel supply source are arranged in a row in the longitudinal direction of the vehicle.

As objective problem underlying the subject matter of claim 1 may therefore be regarded to provide a secure arrangement of a high voltage wiring, a fuel line, a power storing means, a fuel cell and a fuel supply source of a fuel cell vehicle.

None of the relevant documents discloses the solution to the objective problem according to the subject matter of claim 1. Neither do the relevant documents disclose a hint which might lead the skilled person to the subject matter of claim 1 without inventive effort.

- 2.2 Dependent claims 2 to 5 and 7 to 10 do also meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).
- 2.3 Although claims 1, 11, 16 and 17 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The above said with respect to the subject matter of claim 1 applies mutatis mutandis to the subject matters of claims 11, 16 and 17.

Consequently, the subject matters of claims 11, 16 and 17 do also fulfill the requirements of Art. 33(1) and (2) PCT with respect to novelty and inventive step, Art. 33(3) PCT.

- 2.4 Dependent claims 12 to 15 do also meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

## FUEL CELL VEHICLE

## FIELD OF THE INVENTION

The invention relates to a fuel cell vehicle, and more particularly, to on-board  
5 layout technology of high voltage wiring and a fuel line.

## BACKGROUND OF THE INVENTION

Providing a suitable layout for a fuel system (e.g., a fuel cell and high-pressure  
hydrogen tank, etc.) and an electrical system (e.g., a power control unit, motor, secondary  
10 battery, etc.) in a fuel cell vehicle equipped with an on-board fuel cell power generation  
system, which runs using power generated by a motor, is difficult with the limited space  
available on-board. Because hydrogen gas is flammable, the layout must be such that it  
does not leak near the high voltage wiring. JP(A) 2001-71753, for example, discloses  
technology which places the fuel system in the rear portion of the vehicle and the  
15 electrical system in the front portion of the vehicle so as to prevent a fuel line and high  
voltage wiring from being close to one another at the time of a vehicle collision, thereby  
minimizing the possibility of any leaked hydrogen gas igniting.

However, when the layout is such that the electrical system and the fuel system  
20 are separated in the longitudinal direction of the vehicle, as in JP(A) 2001-71753, the  
mounting space for each of the devices is extremely limited given the limited on-board  
space. This drastically decreases the degree of freedom in the layout.



IS/04/2455

- 1a -

Document US 2003/004682 A1 discloses various vehicle body business methods wherein methods and structures are described for facilitating the exchange of modular body components, such as via a removable body floor.

5 Further, document US 6,107,691 discloses a method and apparatus for generating electrical power from multiple vehicles powered by fuel cells while the vehicles are parked in a parking lot, wherein a plurality of spaced-apart electrical receptacles are provided for receiving an electric cable for connection to a parked vehicle for electrically connecting the fuel cell in each of the parked vehicles to the  
10 plurality of electrical receptacles.

Another electric vehicle with a battery box arrangement is disclosed in US 6,220,380 B1, wherein the battery box is supported below a floor panel at a central portion of the electrical vehicle.

15

Document EP 0 677 417 A1 discloses also an arrangement for a drive unit for an electric vehicle, wherein a fuel cell is located in the front portion of the vehicle and a reformer is located in the rear portion of the vehicle.

20 Further, document WO 2004/030968 A1 discloses a fuel cell equipped vehicle wherein hydrogen cylinders storing hydrogen to be supplied to a fuel cell battery, a fuel cell, fuel cell accessories, a storage battery, and a PCU that controls the supply of electric power from the fuel cell and the storage battery to a front wheels-driving electric motor and a rear wheels-driving electric motor are arranged  
25 in that order under a floor of a passenger compartment. Therefore, these major components do not reduce the spaces of a passenger compartment, a forward compartment, and a rearward compartment. Since the devices disposed under the floor of the passenger compartment have relatively great weights, the center of gravity of the vehicle comes to a low position in a central portion of the vehicle,  
30 thus achieving good running stability of the vehicle.

### SUMMARY OF THE INVENTION

25 One object of the invention is thus to provide a fuel cell vehicle having a layout configuration in which high voltage wiring and a fuel line are arranged apart from one another, while increasing the degree of freedom in the layout of on-board devices.

A first aspect of the invention relates to a fuel cell vehicle equipped with a power

- 1 -

fair copy(amended) CLAIMS

1. A fuel cell vehicle equipped with a power control unit which converts power supplied from a fuel cell and supplies that converted power to a load, a fuel supply source and power storing means, wherein high voltage wiring, which connects at least one of the fuel cell and the load to the power control unit, is provided on one side of either the left or the right side of a vehicle, and a fuel line for supplying a fuel gas to the fuel cell is provided on the other side of the vehicle, which is opposite the side on which the high voltage wiring is provided, wherein the high voltage wiring extends on one side of either left or right side of the vehicle in a longitudinal direction of the vehicle, wherein the fuel line extends on the other side of the vehicle in the longitudinal direction, wherein the high voltage wiring and the fuel line are spaced apart from one another in the lateral direction of the vehicle, and wherein the fuel cell, the power storing means and the fuel supply source are arranged in a row in the longitudinal direction of the vehicle.
2. The fuel cell vehicle according to claim 1, wherein the power control unit includes a connector for connecting the high voltage wiring to the power control unit, and the connector is arranged in the longitudinal direction of the vehicle facing the one side.
3. The fuel cell vehicle according to claim 1 or 2, wherein the vehicle includes the fuel supply source which supplies the fuel gas to the fuel cell, and the connector of the power control unit is positioned on the opposite side of the vehicle, in the lateral direction of the vehicle, from the location where the fuel supply source and the fuel line are connected.

- 2 -

4. The fuel cell vehicle according to claim 3, wherein the fuel supply source includes a vessel in which the fuel gas is stored.
5. The fuel cell vehicle according to claim 4, wherein the vessel is a hydrogen gas tank.
6. The fuel cell vehicle according to any one of claims 1 to 5, wherein the power control unit is enclosed in a case, and the case is generally L-shaped or T-shaped.
7. The fuel cell vehicle according to any one of claims 1 to 6, further comprising:  
a first frame and a second frame, both of which extend in the longitudinal direction of the vehicle, and wherein the high voltage wiring is provided along the first frame and the fuel line is provided along the second frame.
8. The fuel cell vehicle according to claim 7, wherein the high voltage wiring and the fuel line are provided between the first frame and the second frame.
9. The fuel cell vehicle according to any one of claims 1 to 8, further comprising:  
a third frame provided at a front portion of the vehicle that extends in the lateral direction of the vehicle;  
a fourth frame provided at a rear portion of the vehicle that extends in the lateral direction of the vehicle, and wherein  
the high voltage wiring and the fuel line are provided between the third frame and the fourth frame.

- 3 -

10. The fuel cell vehicle according to claim 9, wherein the fuel supply source, the fuel cell, the load, and the power control unit are arranged surrounded by the first frame, the second frame, the third frame, and the fourth frame.
11. A fuel cell vehicle equipped with a power control unit which converts power supplied from a fuel cell and supplies that converted power to a load, wherein the fuel cell, the power control unit, power storing means and a fuel supply source that supplies a fuel gas to the fuel cell are provided under a floor of a vehicle cabin, and a fuel line that connects the fuel cell to the fuel supply source and electrical wiring that connects the fuel cell to the power control unit are provided spaced apart from one another in the lateral direction of the vehicle, wherein the high voltage wiring extends on one side of either left or right side of the vehicle in a longitudinal direction of the vehicle, wherein the fuel line extends on the other side of the vehicle in the longitudinal direction, and wherein the fuel cell, the power storing means and the fuel supply source are arranged in a row in the longitudinal direction of the vehicle.
12. The fuel cell vehicle according to claim 11, wherein the fuel cell, the power control unit, and the fuel supply source are arranged in that sequence from the front of the vehicle.
13. The fuel cell vehicle according to claim 12, further comprising:  
power storing means, and wherein  
the fuel cell, the power control unit, the power storing means, and the fuel supply source are arranged in that sequence from the front of the vehicle.
14. The fuel cell vehicle according to claim 13, wherein the fuel supply source includes a vessel in which the fuel gas is stored.

- 4 -

15. The fuel cell vehicle according to claim 14, wherein the vessel is a hydrogen vessel in which hydrogen is stored.
16. A fuel cell vehicle comprising:  
a fuel cell;  
power storing means;  
a fuel supply source;  
a load;  
a power control unit which converts power supplied from the fuel cell and supplies that converted power to the load;  
high voltage wiring, which connects at least one of the fuel cell and the load to the power control unit, the high voltage wiring being provided on one side of either the left or the right side of a vehicle in a longitudinal direction; and  
a fuel line for supplying a fuel gas to the fuel cell, the fuel line being provided on the other side of the vehicle in a longitudinal direction, which is opposite the side on which the high voltage wiring is provided, wherein the high voltage wiring and the fuel line are spaced apart from one another in the lateral direction of the vehicle, and wherein the fuel cell, the power storing means and the fuel supply source are arranged in a row in the longitudinal direction of the vehicle.
17. A fuel cell vehicle comprising:  
a fuel cell provided under a floor of a vehicle cabin;  
power storing means provided under the floor of the vehicle cabin;  
a power control unit provided under the floor of the vehicle cabin, which converts power supplied from the fuel cell and supplies that converted power to a load;  
a fuel supply source provided under the floor of the vehicle cabin, which supplies a fuel gas to the fuel cell;

- 5 -

a fuel line which connects the fuel cell with the fuel supply source; and electrical wiring which is provided spaced apart, in the lateral direction of the vehicle, from the fuel line, and which connects the fuel cell with the power control unit,

wherein the high voltage wiring extends on one side of either left or right side of the vehicle in a longitudinal direction of the vehicle, wherein the fuel line extends on the other side of the vehicle in the longitudinal direction, and

wherein the fuel cell, the power storing means and the fuel supply source are arranged in a row in the longitudinal direction of the vehicle.